LINCS
COMMUNITY, COURSES, AND RESOURCES FOR ADULT EDUCATION

Inspired by Mathematical Mindsets?

Study Guide: A LINCS Book Study to discuss Jo Boaler's *Mathematical Mindsets*

The LINCS Community of Practice Math and Numeracy group will host a book study in a microgroup from April 17 – May 21, 2017. The book group will read and discuss *Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching*, 1st edition (ISBN: 0470894520) by Jo Boaler. *Mathematical Mindsets* provides practical strategies and activities to help teachers show learners, even those that are convinced they are "bad at math", that they can enjoy and succeed in math.

This document provides the schedule and discussion questions that will guide the book group. Participate in the live discussion or print these discussion questions to host your own book group with colleagues.

Objectives

- Participants will learn key concepts presented in *Mathematical Mindsets.*
- Participants will apply these concepts in their own settings.
- Participants will deepen their learning through online discussion with other participants.

Is this book study a good fit for me?

Mathematical Mindsets shares research and many practical classroom suggestions for developing a growth mindset around learning math. This is a powerful concept that can open math learning for teachers as well as students. Through this book study, adult educators can reflect on their own relationship with learning math as well as gain concrete strategies for approaching math in a way that does not reinforce the negative experiences that many adult learners have had with learning math. Program managers and coordinators are encouraged to join because a significant component of mathematical mindsets has to do with grouping and course progressions. If possible, find a local colleague that can read the book along with you so you can discuss possible applications in your own context. Questions will be posted weekly in the discussion board. Please share your ideas there!

Meet the Facilitator

Amy Vickers is an adult basic education instructor specializing in numeracy. She believes that math is for everyone! Drawing on her experience in the adult education classroom as well as a professional developer, Amy will post discussion questions within the LINCS community discussion. She will facilitate the ongoing discussion, pointing out places where the discussions overlap, and contributing follow-up questions and additional resources as needed.

To Prepare for the Book Study

1. Buy or borrow *Mathematical Mindsets.*
2. Find a local colleague or group to read with you and set times to meet or talk if possible.
3. Create a LINCS account and join the Math and Numeracy group. Then join the micro-group called *Book Study: Mathematical Mindsets by Jo Boaler*.
4. Begin reading! Discussion questions and a math task for chapters 1 – 3 will be posted in the LINCS discussion forum on April 17th.

Math Tasks

The Adult Numeracy Network's Professional Development Principles state that sound professional development should begin with teachers as mathematics learners and thinkers. Following that principle, in addition to the discussion questions, a Math Task related to the reading will be offered each week. These are tasks that can certainly be shared with students, but as we go through the book study together, approach the task as a mathematics learner and thinker so you can have your own experience with the excitement of discovering mathematical ideas. Each task was chosen to be accessible and challenging regardless of the math level that is familiar to you. As you approach these tasks, please try to let go of ideas of math that you can and can't do and just work with the activity as it is given. Share your experiences and thoughts about the math task in the group. Have fun!

Schedule

Date	Discussion	Math Task
April 17	Questions posted for Chapters 1 – 3.	Make several copies of Pascal's Triangle, p 222. Use crayons, markers, colored pencils, or paint as you look for patterns. Just dive in! All of your conjectures may not show patterns. Share your work on the discussion board.
April 24	Questions posted for Chapters 4 - 5.	Complete the Negative Space Task on p 223. Answer questions 1 – 3 on that page. Share your questions, thoughts, sketches, process, mistakes, or solutions in the discussion board.
May 1	Questions posted for Chapters 6 - 7.	Complete the Growing Rectangles activity on pages 237 – 238. Share your questions, thoughts, sketches, process, mistakes, or solutions in the discussion board.
May 8	Questions posted for Chapters 8 - 9.	Complete the Highlighting Mathematical Connections activity on p261. Share your questions, thoughts, sketches, process, mistakes, or solutions in the discussion board.
May 15	Wrap-up questions posted.	

Discussion Questions

Each set of discussion questions includes questions intended to facilitate reflection on the concepts in the book and your teaching practice. In addition, there are suggested *Challenges.* The purpose of these *Challenges* is to provide an opportunity to take your work beyond the discussion board and create a product to be used in your classroom or by others.

Chapters 1 – 3

1. What are some key points about brain science that would be beneficial for adult learners to know? What are some effective ways to share those points with colleagues and/or students?

   Challenge: Create a poster, article, short video, or other illustration that effectively shares key points about brain science related to mindset, mistakes, and/or learning mathematics. Share your work in the discussion board.

2. Which strategy for valuing mistakes resonates with you? What are some other ways to show the value of mistakes?

3. When students encounter new ideas that do not appear to fit into their existing mental model, they experience *disequilibriu*m: "A person in disequilibrium knows that new information cannot be incorporated into their learning models, but the new information also cannot be rejected because it makes sense, so they work to adapt their models." (page 18)
   What are some ways that this concept could apply in a classroom of adult learners?

4. What do you find to be creative or beautiful about mathematics?

5. Conrad Wolfram's four stages of working on mathematics are…
   a. Posing a question
   b. Going from the real world to a mathematical model
   c. Performing a calculation
   d. Going from the model back to the real world, to see if the original question was answered.

   Challenge: Reframe a familiar lesson to follow Wolfram's four stages of working on Mathematics. Write a simple lesson plan and share it in the discussion board.

6. What else struck you about chapters 1 – 3?

7. What will you add to, change about, or remove from your teaching practice based on what you learned in chapters 1 – 3?

Chapters 4 – 5

1. When you learn new math concepts, at first they take up a large space in your brain, but then *compression* happens, which allows you to use that concept easily without thinking about it (page 37). What are some ways that an understanding of compression could apply in a classroom of adult learners?

2. Why is it important to teach conceptual understanding of multiplication?

   Challenge: Print the Math Cards mentioned on page 40. Design a simple activity using these cards that would be meaningful for your students. Share a description of the activity in the discussion board.

3. On page 45, Boaler describes the value of non-examples, or examples that do not fit the definition. Why are *non-examples* important to learning math? How could you incorporate *non-examples* into your instruction?

4. Do you ask students to reflect on the math that they have learned? What are your favorite reflection questions? What do you like about those questions?

5. Look at the six questions that Boaler uses to create rich mathematical tasks. Which question appeals to you? Why? Which question is the most challenging for you? Why?

   Challenge: Use at least one of the questions to revise or create an activity for your class. Share the activity in the discussion board.

6. What else struck you about chapters 4 – 5?

7. What will you add to, change about, or remove from your teaching practice based on what you learned in chapters 4 – 5?

Chapters 6 – 7

1. What are some examples of math elitism that Boaler shared? Where have you seen math elitism? What are some specific ways that you could challenge math elitism?

2. Which of the equitable strategies resonate with you? What is interesting to you about that strategy?

   Challenge: In collaboration with colleagues, use the equitable strategies to revise a lesson, a unit, a course sequence, or any other activity provided by your program to make math more inclusive. Share your plan in the discussion board.

3. Which of Boaler's suggestions for teaching heterogeneous groups effectively was interesting to you? How could you apply Boaler's suggestions for teaching heterogeneous groups effectively to working with the multi-level classes that exist in most adult education programs?

4. "In a multidimensional math class, teachers think of *all* the ways to be mathematical. Mathematicians…perform calculations at some times, but they also have to ask good questions, propose ideas, connect different methods, use many different representations, reason through different pathways, and many other mathematical acts" (page 121).
   What is the value of multi-dimensionality in an adult education setting? How can your students benefit from multi-dimensionality?

5. How could teaching students to be responsible for each other's learning help them while learning math? How could this help them outside the classroom?

   Challenge: Think of a teacher who is interested in teaching students to be responsible for each other's learning, but not sure how to begin. Based on what you read and your own experience, design a few simple classroom routines or activities to get this teacher started. Share your suggestions in the discussion forum.

6. What else struck you about chapters 6 – 7?

7. What will you add to, change about, or remove from your teaching practice based on what you learned in chapters 6 – 7?

Chapters 8 – 9

1. How can you use Boaler's ideas about testing, grades, and feedback to adjust the way that you communicate to learners about the standardized tests required for most adult education programs?

2. How could you first identify and then share with students where they are now, where they need to be, and ways to close that gap?

   Challenge: Write or draw a model that specifically describes how to identify where a student is now, where they need to be, and ways to close that gap; this exact process could look different in different programs. How will you communicate that information to your students? Share your model in the discussion forum.

3. Which of the nine strategies for encouraging students to become more aware of the math they are learning and their place in the learning process would like to try? What appeals to you about that strategy?

4. Reflect on the Positive Norms to Encourage in Math Class on page 269 – 277. Which are you already encouraging? Which would you like to encourage more? How will you encourage those norms? What other positive norms do you encourage?

5. Which of the suggestions for teaching math for a growth mindset appeal to you? What is interesting to you about that suggestion?

   Challenge: Use the suggestions in this chapter to revise an activity that you already use to incorporate a growth mindset. Share that activity in the discussion forum along with a short description of how growth mindset is incorporated.

6. What else struck you about chapters 8 – 9?

7. What will you add to, change about, or remove from your teaching practice based on what you learned in chapters 8 – 9?

Wrap-up

1. Review the previous four weeks of discussion. What will you add to, change about, or remove from your teaching practice based on what you learned from this discussion?

2. What other questions do you have about developing Mathematical Mindsets in yourself and in your students?

3. What is your most powerful take-away from reading and discussing *Mathematical Mindsets*?